SILVICULTURE

...is growing trees

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

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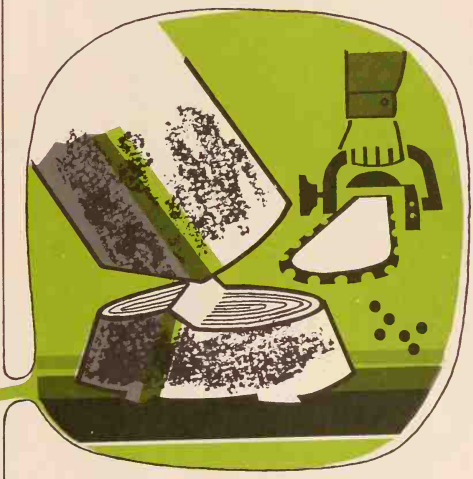
Forests and forestry are much in the news these days. More and more the public is looking over the forester's or the landowner's shoulder and asking, "What is going on here?" Indeed, what-to-do-about-our-forests is such a newsworthy topic that there is an increasing need for a clear understanding of what forestry really is.

The essence of forestry—the art and science of growing forests—is called silviculture. And that is what this booklet is all about. Of course, there is more to forestry than silviculture, but understanding the basic silvicultural options available for treating a forest is a first big step in exploring the entire range of forestry. In its broadest sense, forestry includes economic, social, and philosophical as well as biological considerations; silviculture deals primarily with the biological aspects of growing trees.

Despite its recent emergences as a national "issue," forestry—and more specifically, silviculture—is not a new invention. It has been known and practiced in Europe for hundreds of years and in this country for nearly a century.

A brief treatment of a complex subject must, of course, generalize and simplify, and that is what we have done in the following pages. We are more concerned here with the principles of silviculture than with specific applications. The discussion should help the reader to better understand what he reads and hears about forestry, and sees for himself in the woods. He will also learn to use some of the terms defined and—more importantly perhaps—know when they are being misused.

Much of what a forester does to "manage" a forest may be likened to the work of a gardener: he nurtures those plants that are good for his purpose and removes those that are not. Many times the good ones are nurtured by removing the less desirable ones. So, among the many tools available to the forester—including even fire—the chain saw is probably the one more commonly used. For silviculture generally involves cutting trees.



We must recognize too that all forests are not harvestable. Because of certain critical characteristics of such things as soil, topography, or climate, some forests are so environmentally "delicate" that they should not be logged. Knowing when not to disturb a forest is part of the forester's art and science. Moreover, the demand for natural or wilderness areas is increasing. Such areas, likewise, are not actively managed for timber. But when we talk about silviculture we are talking about developing a plan for a forest and then doing whatever is necessary to cause the forest to grow in a certain way and produce something we need or want, whether it be timber, wildlife, water, recreation, beauty, or any combination of these.

Although all silvicultural systems are based on the biological requirements of the trees themselves, how they are applied depends on the specific desires and goals of the landowner. He may want to grow commercial timber, provide a habitat for wildlife, regulate and protect a water supply, maintain a "thing of beauty," or combine several of these goals. Silviculture merely provides the most effective means to achieve that end.

Usually when a forester or landowner plans a silvicultural treatment for a specific forest he has one (sometimes both) of two specific objectives in mind: to improve the composition and increase the growth of the existing forest (intermediate cutting) or to facilitate the production of new trees within or in place of the old forest (regeneration cutting).

intermediate cutting

A forester can improve a stand in several ways; how he does it is again similar to the ways a gardener improves his flower beds. He can regulate the composition by eliminating some trees and encouraging others—this is called "weeding" or "cleaning." He can increase the growth rate in a dense stand by removing some of the trees to give the better ones more room to grow—this

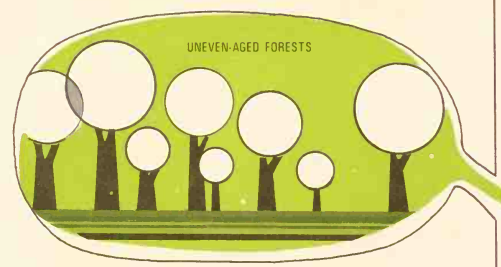
is called "thinning." He can help a neglected uneven-aged stand by removing trees of undesirable species, form, or condition—this is called "improvement cutting." After a natural or accidental disaster such as fire, insect or disease attack, wind or ice storm, he can remove the dead, dying, and damaged trees. If he does this primarily to utilize the wood before it rots, it is called "salvage" cutting; if he does it mainly to prevent the spread of insects or disease, it is called "sanitation" cutting. If the entire stand must be removed, the result is a regeneration cut.

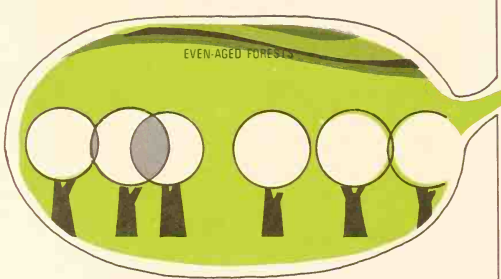
Once the decision has been made to manage a forest and specific objectives have been established, applying these intermediate cutting treatments becomes a matter of putting the forester's professional skills to work.

regeneration cutting

The most critical silvicultural decision comes when it is time to reproduce a forest (or part of a forest) or, more appropriately, to help the forest reproduce itself, because the species established will cover the land for many years. Important as the regeneration cut is, however, it is merely the climax of a series of silvicultural cuttings made in a managed forest. Normally, many trees have been cut throughout a generation of growth before this cut is made. There are some exceptions, such as with short-lived species where intermediate cuts are not usually made. The forester usually prefers to let nature do the reproducing; he just tries to create conditions favorable to the process. He knows that what he can do on any particular tract of land is limited by the ecological forces at work on that land; in short, he must work with, not against, nature. A good forester, then, is a practicing ecologist.

To be sure, not all forests are produced naturally. In certain situations it is desirable, sometimes necessary, to establish a forest artificially by seeding or planting. Such situations include starting a new forest on cleared land, re-establishing a certain species in an area where there is no natural seed source nearby, and introducing a new or genetically improved species to an area. Billions of trees have been planted in the past half century and





millions more will be planted in the future. But we are mainly concerned here with the natural regeneration process.

There are four basic ways of cutting to regenerate a forest: selection, shelterwood, seed-tree, and clearcutting. The main difference among these methods is the resulting degree of exposure of the forest floor to sunlight and atmospheric conditions. The professional forester can and does use combinations and variations of the four methods, but for the sake of simplicity, we will consider each in its classical or "pure" sense. The main purpose of these treatments is to create conditions that will allow the forest to renew or reproduce itself, so they are properly called "regeneration" methods rather than "harvesting" methods, even though merchantable trees are removed.

Choosing the appropriate system is a complex process involving ecological, economic, and, increasingly, sociological considerations. It is here that the forester's skill and perception come into play. Balances must be struck and trade-offs made between costs and aesthetics, immediate and future needs, productivity and preservation.

Basic to choosing a system are the characteristics of the land itself: soil, topography, moisture, microclimate. Equally essential of course are the capabilities of the vegetation that grows on the land: seeding habits, growth patterns, and something foresters call "tolerance"—the ability of a tree to grow in the shade of other trees.

Important too, in considering how best to regenerate a forest is the concept of uneven-aged and even-aged forests. Uneven-aged forests contain a "family" of trees, a wide variety of ages and sizes from the tiniest seedlings to the statliest monarchs. Even-aged forests, on the other hand, consist mainly of a single generation of trees, usually not differing in age more than 20 years. In nature, an uneven-aged forest tends to contain many "tolerant" trees, the young trees growing in the shade of the older ones. Even-aged forests, on the other hand, contain more "intolerant" trees, growing side-by-side so as not to get in each other's way. Forest management provides for some leeway, however, allowing some moderately intolerant species to be grown in uneven-aged forests and tolerant ones, with careful manipulation, to be grown in even-aged forests. As we shall see, of the four regeneration systems, the selection system is the only one that

produces an uneven-aged forest; the other three create even-aged conditions. It is important, perhaps reassuring, to note that nature does it both ways.

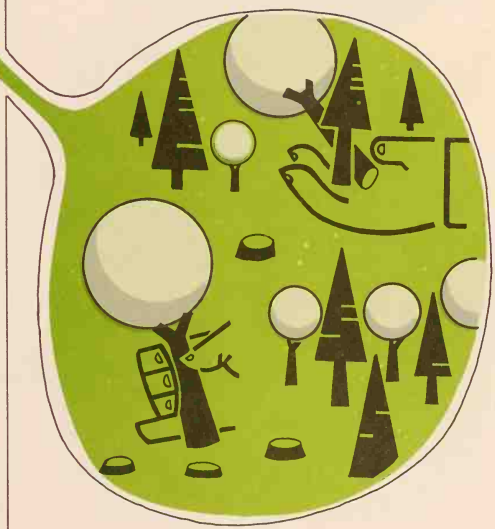
With this background, the four basic regeneration systems and the reasons for their differences can be more readily understood.

selection system

In the selection system, the forester selects trees individually (or in small groups) for cutting. Such a cutting could be made each year, but usually the cutting interval is 5 years or more. Trees of all size are removed in this type of regeneration cutting. Large, mature trees are harvested for wood products and to create openings for new growth; smaller trees are removed for much the same reasons as intermediate cuts are made in even-aged stands: to remove diseased and poorly formed trees and undesirable species and to reduce crowding and hence stimulate growth on the remaining trees.

A variation of individual tree selection is "group selection" wherein small groups of adjacent trees are cut rather than just single trees. This creates slightly larger openings in the forest and admits more light to stimulate new growth. The selection system has the least visual impact, especially to the casual passerby; the forest always looks the same and only a close inspection reveals any changes in the forest stand.

Tolerant species are best suited for managing by the selection system because the ground under such a stand is generally shaded. Moreover, this system depends upon and is intended to maintain an uneven-aged condition. Rather than undergoing a brief period of regeneration, as in the other three methods, a selection forest is being regenerated continually by new trees that spring up where the mature ones were removed.



shelterwood system

In the shelterwood system the new stand is established under the shelter of older trees. This method is used for species that generally do not compete well with other vegetation when growing in direct sunlight, especially in their early years. Two cuts are commonly made, sometimes three. The first stimulates seed production by the trees that are left, prepares the site for the seed by stirring up the ground, and lets in some light. Usually, enough old trees are left to shade all of the area at least part of each day. Soon new seedlings establish themselves beneath the older trees as a result of this first cut, or sometimes they occur naturally. The subsequent cut (or cuts) removes the remaining mature trees, completely releasing the young stand. An even-aged stand results.

Aesthetically, the area nearly always looks like a "forest," because by the time the last of the mature trees are removed, the young stand is fairly well along. A potential hazard is that some of the young trees may be damaged when the old ones are felled.

seed-tree system

This system also takes two cuts to regenerate the stand. The first cut removes most of the trees, leaving only a few scattered over the area to produce seed for the new crop. The logging itself helps by stirring up the ground, preparing it to receive the seed. Several years later, when the young trees have established themselves, the seed trees are removed to salvage the wood in them.

This method is restricted to firmly rooted species that will not blow over when the forest is suddenly opened up and exposed to strong winds. It is resorted to only when not enough seeds or seedlings are on the ground to pro-

duce a new forest and there is little or no chance that seed from adjacent stands will adequately cover the area cut. Intolerant species do best in this system because the young seedlings develop in nearly full sunlight. The first cut drastically alters the appearance of the forest. Use of the seed-tree system results in an even-aged forest.

clearcutting

Clearcutting is the removal of all trees larger than an inch or two in diameter from a specific area. Drastic as it may seem, clearcutting plays a legitimate and prominent role in scientific forestry. Properly done, it paves the way for a new, unencumbered and hence vigorously growing forest. For tree species that are most intolerant of shade, this is generally the most practical regeneration method. Not only does the process eliminate all growth-suppressing shade, but the intensive logging activity exposes mineral soil, thereby improving conditions for seed germination and rapid early growth of young trees. Application of this method of regeneration assumes that an ample supply of seeds or seedlings or both is already on the ground or that seed will be blown in from nearby stands. If an adjacent seed source is to be depended upon, size and shape of the clearcut will be restricted by the distance seed can be carried by the wind. In some forest types the regeneration is in the form of sprouts from roots and stumps. Clearcutting produces even-aged stands.

From the scenic or aesthetic viewpoint, clearcutting is indeed drastic. For the first few years after a clearcutting, there is no conspicuous forest present. A cursory look may even suggest that the forest has been destroyed. But closer scrutiny will reveal an infant stand making maximum use of the full sunlight. The initial visual impact may be tempered, however, by strategically regulating the size, shape, and location of the clearcut areas so that they blend in naturally with the landscape.

nature as a silvi-culturist

These systems are not strictly the creation of man, but rather adaptations of natural processes. For nature itself makes "regeneration cuts" by means of fire, insects, disease, wind—sometimes "selecting" a single tree at a time, sometimes a group, and sometimes "clearcutting" an entire forest. The forester merely tries to "tame" some of these processes, making them work a little faster perhaps and toward some predetermined ends. And that is what silviculture is all about.

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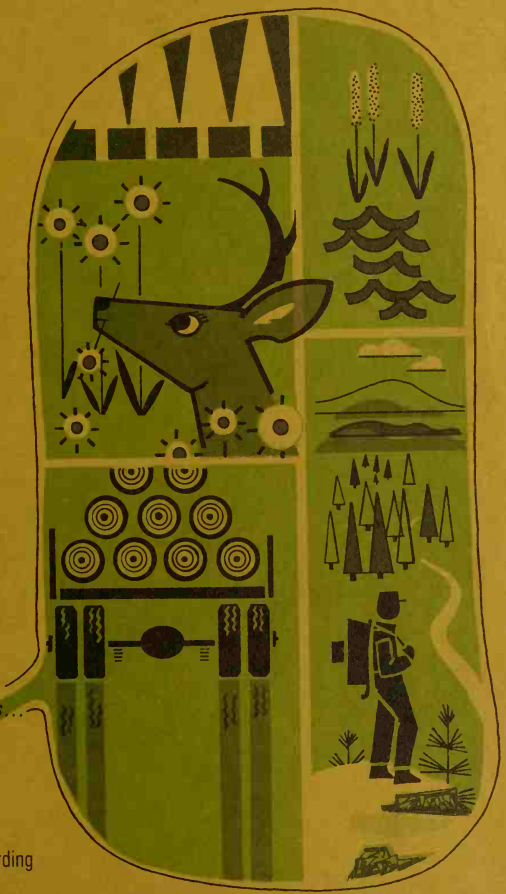

Silviculture, then, is growing trees for many uses...

- For the wood that is in them
- For the wildlife that lives among them
- For the water that filters through them
- For the sheer pleasure they afford humankind

And although the practice of silviculture may vary according to purpose, the principles remain the same.

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